ADDITIONAL RECORDS OF PLEISTOCENE LIZARDS FROM FLORIDA

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Up to a few years ago, fossil lizard remains from Florida were unknown. Vanzolini (1952) was the first to bring attention to the Miocene lizards of Florida by describing *Peltosaurus floridanus* from the Thomas Farm, Gilchrist County. Brattstrom (1953a) reported *Sceloporus* and *Eumeces* from the Pleistocene and/or Recent deposits of Vero, St. Lucie County. Auffenberg (1955) reported *Ophisaurus* from both Pliocene and Pleistocene deposits in the State.

The present paper deals with Pleistocene material collected recently, adding a few more genera to the list of fossil lizards previously known from Florida. It also provides an opportunity to indicate new localities from which fossil lizards have been obtained.

Specimens cited in this paper are found in the collections of the University of Florida (UF) and the Florida Geological Survey (FGS).

Fossil lizards are now known from the following Pleistocene localities:

ILLINOIAN [1]

Haile II B (R 17 E, T 9 S, SW¼ of Sec. 24), near the town of Haile, Alachua County. *(Ophisaurus ventralis, Ophisaurus compressus* and *Anolis carolinensis).*

Arredondo I (formerly known as Kanapaha I, Auffenberg, 1955) (R 19 E, T 10 S, SE¼ of NW¼ of Sec. 22), near the town of Arredondo, Alachua County. (Locality A—*Anolis carolinensis;* Locality B—*Anolis carolinensis).*

Reddick I B (R 21 E, T 13 S, W½ of Sec. 14), approximately 1 mile south of Reddick, Marion County. *(Anolis carolinensis, Cnemidophorus sexlineatus, Ophisaurus ventralis* and *Eumeces* cf. *fasciatus).*

[1] Stratigraphically these deposits seem to represent the Illinoian glacial period (Brodkorb, in press).

Wisconsin or Post Wisconsin

Bradenton Field I. One mile south of the business district of Bradenton, Manatee County, approximately 100 yards east of the Tamiami Trail, in the north bank of a drainage canal (Simpson, 1930, gives additional stratigraphic and faunal data). *(Anolis carolinensis).*

Winter Beach-Luther Locality (R 39 E, T 32 S, S½ of NE¼ of Sec. 3), approximately 5.6 miles north of the original Vero Beach locality, St. Lucie County. Herbert H. Winters correlates this deposit with the North American Thermal Maximum (personal communication). *(Anolis carolinensis).*

Vero, St. Lucie County. Brattstrom (1953a) has reported *Sceloporus undulatus* and *Eumeces* sp. from Stratum 3 of this deposit.

A number of lizard remains are known from deposits indicating definite admxiture of Wisconsin, Post-Wisconsin and/or Recent faunal zones. These are:

Itchtucknee Springs (R 16 E, T 6 S, W½ of Sec 7), approximately 5 miles west of Ft. White, Columbia County (Simpson, 1930, gives additional information). *(Anolis carolinensis).*

Rock Springs (R 28 E, T 20 S, Sec. 11), approximately 4 miles southeast of Mt. Plymouth, Orange County. *(Anolis carolinensis).*
Lithia Springs (R 21 E, T 30 S, Sec. 16), near Lithia, Hillsborough County. A list of fossil vertebrates from this locality includes Miocene marine, and Pliocene (?), Pleistocene and Recent terrestrial and fresh water forms. *(Anolis carolinensis).*

Material Examined

The fossil lizard material upon which the above is based is composed of the following:

Cnemidophorus cf. sexlineatus

A lizard belonging to the family Teiidae is represented by a single fragmentary dentary (fig. 1), collected from an Illinoian (?) deposit at Reddick I B, Marion County. The fossil dentary (UF 5089) is represented by the posterior portion of that element, bearing nine biscuspid teeth, with spaces for two more. The Meckelian Groove is broad and open. The teeth are somewhat compressed, though not greatly so. The largest cusp is the posterior one.

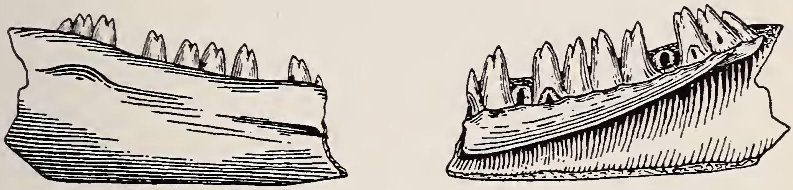

Fig. 1. A fragmentary fossil right dentary referred to *Cnemidophorus* cf. *sexlineatus*. External and lingual views. UF 5089, Reddick I, Marion County, Florida, Pleistocene, Illinoian?

The closest agreement is found between this fragment and the dentaries of four species of *Cnemidophorus* examined as Recent comparative material (*sexlineatus* - 4 specimens, *gularis* - 1 specimen, *tigris* - 1 specimen and *tesselatus* - 1 specimen). A concise specific identification seems impossible at the present time. The element is provisionally referred to the eastern species, *C. sexlineatus,* on zoogeographic grounds.

Anolis carolinensis

The dentary of *Anolis* is fairly diagnostic, and the presence of this lizard in fossil collections is easily determined if this element is available. It is long, low, with little curvature from above. The Meckelian Groove is very reduced in young specimens, and usually absent in adults; at least anteriorly. The teeth are pleurodont, well developed, slightly compressed, rather high, heterodont, bearing single cusps anteriorly, and three cusps posteriorly. There are no lateral striations on either the cusps or the shafts.

Remains of this lizard are very common in Pleistocene and Pleistocene and/or Recent deposits in Florida. It is now known from Illinoian and Wisconsin and/or Post-Wisconsin deposits. A number of dentaries, maxillae, a parietal, some frontals, a quadrate, a femur and a number of thoracic vertebrae are now available. It is known from the following localities:

Illinoian (?).

Haile II B. UF 5687, 3 frontals and 8 fragmentary dentaries. UF 5682, 1 femur and 5 fragmentary maxillae.

Arredondo I A. UF 5987, a fragmentary maxillary and 1 dentary.

Arredondo I D. UF 5094, a single dentary.

Wisconsin and/or Post Wisconsin.

Winter Beach-Luther Locality. UF 5829, 15 dentaries, mostly fragmentary, a number of isolated vertebrae, 6 frontals and 1 quadrate.

Bradenton Field I. UF (uncat.) several dentaries.

Pleistocene and/or Recent.

Itchtucknee Springs. UF 50913, 1 dentary.

Rock Springs. UF 5050, 1 dentary.

Lithia Springs. UF 5151, 1 dentary.

The dentaries of a number of modern species of *Anolis* cannot be separated. On the other hand, some species are quite distinct. *Anolis alliaceus* possesses 33 dentary teeth, being considerably more than are found in either the fossil elements, or in modern specimens of *carolinensis*. *Anolis cybotes* is quite distinctive in that the external surface of the dentary is decidedly thickened and rugose. This thickening does not occur on either the fossil elements or in Recent specimens of *A. carolinensis*. The number of teeth and the lingual dentary surafce in *A. cybotes* are very similar to those of *carolinensis*. *Anolis trossulus* and *A. equestris* both have a higher number of teeth than are found in either the fossil dentaries or in *A. carolinensis*. *Anolis equestris* is further separated on the basis of its large size. Neither the fossil elements nor the available Recent specimens of *Anolis carolinensis* can be separated from a number of West Indian anoles in which I have examined the dentary *(distichus, lineatopis* and *chloro-cyanus)*. Skeletal material of mainland anoles would undoubtedly show that many of these are also indistinguishable from the fossil specimens from Florida.

The fossil dentaries are identical in shape to those found in a large series of Recent specimens of *Anolis carolinensis*. The number of teeth in the fossil dentaries varies from 19-27 (M=22.5). In a large series (72) of skulls of Recent *A. carolinensis* the number of teeth varies from 19-25 (M=22.9). Two fossil specimens

(UF 9871), both from the same locality (Winter Beach-Luther), posses 26-27 teeth, a higher number than found in the larger Recent series of skulls. These elements are also larger than any other fossil or Recent dentary which I have seen.

The number of teeth in *Anolis carolinensis* is quite variable. There is no definite correlation between size of the individual and number of teeth. Some Recent West Indian anoles have a higher number of teeth than are found in *carolinensis (equestris, trossulus* and *alliaceus)*, but there is little reason to refer the fossil elements to any species other than the form found in Florida today. Unless other evidence becomes available it seems best to refer the two fossil dentaries to this, rather than an exotic species of anole. A fossil dentary is illustrated in figure 2.

The fossil femora available from some of the Pleistocene deposits are of little value in determining the specific identity of the fossil anoles from Florida.

The maxillae (fig. 2) available from several Pleistocene deposits are identical to those in *Anolis carolinensis* in shape, rugosity, and number of teeth. However, they are also indistinguishable from a number of other species which I have examined. The number of teeth in this element in *carolinensis* varies from 15-22 (M=18.3). In the fossil elements the number varies from 17-21 (M=18.9).

The fossil frontals are of considerably more importance since rugosities reflect, in part, both keels and ridges in the supraorbital region; as well as, to some extent, scalation. Most of the fossil elements have at least some suggestion of a median frontal ridge. This ridge underlies the somewhat raised median row of scales between the orbits. This can be demonstrated in modern specimens of *carolinensis,* where the ridge is evident in especially large individuals. The structure is more conspicuous when it is not covered with scales, so that preserved or living specimens will show a less developed ridge than if the bone were exposed.

The structure is a common feature in many living species of *Anolis.* However, it is not found in all members of the genus. It is well developed in *Anolis carolinensis, A. brunneus* and *A. porcatus.* All of these species have small heavily keeled scales in this region, aligned in a median linear fashion. Presumably the frontals of *brunneus* and *porcatus* posses a bony ridge. The structure seems best developed in *carolinensis.* Externally it is broader in *procatus* than in *carolinensis.* In the fossil elements the ridge, when present, is high and narrow, as in *carolinensis.*

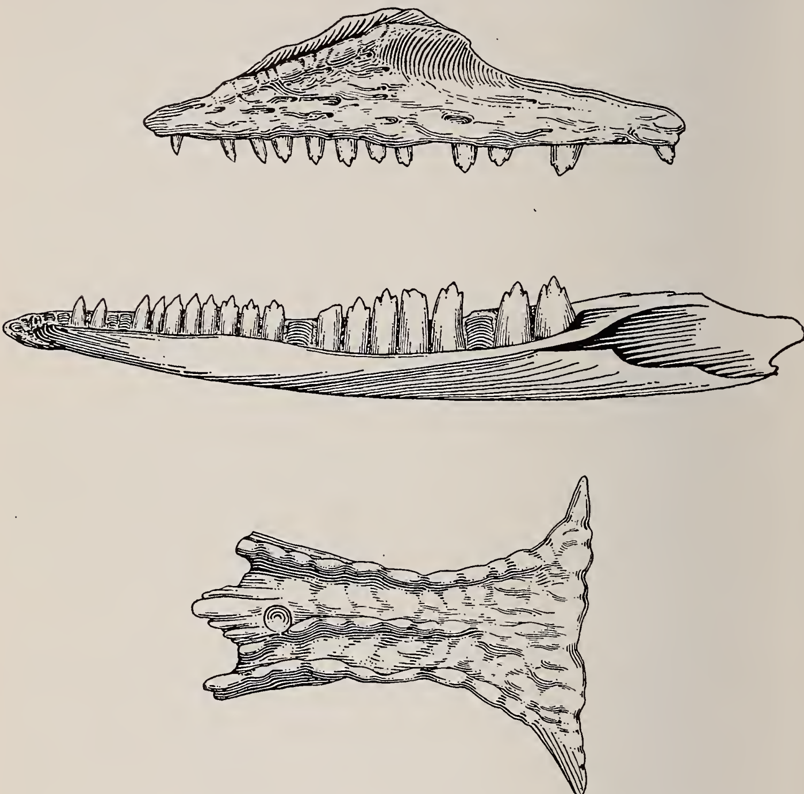

Fig. 2. Fossil skull elements of *Anolis carolinensis.* Upper. Left maxillary, external view. US 5829. Middle. Right dentary, lingual view. UF 5829. Lower. Frontal, dorsal view. UF 5829. All of the elements are from the Winter Beach-Luther Locality. Post-Wisconsin? Thermal Maximum?

One of the fossil frontals has the ridge developed to a greater degree than in any modern skulls of *carolinensis.* It is, however, one of the largest elements I have seen, and, judging from the modern series of *carolinensis* available, this character is correlated with age; the larger specimens possessing the highest and most well developed ridges. Individual and sexual dimorphism may also play a part in the observed variability of this character.

The sculpturing of the frontal in *Anolis* is apparently influenced by scalation. However, the exact shape of the rugosities do not reflect the boundaries of single scales. In preserved specimens a number of small rugosities underlie a single scale. It is therefore difficult, but not altogether impossible, to determine, in general, the scalation immediately above the frontal in the Pleistocene anoles.

The edges of the scales can be approximated by following the deepest "valleys" between the rugosities. The frontal scalation of the Pleistocene anoles of Florida, as reconstructed by this method, does not differ from that found in *Anolis carolinensis*.

A fossil frontal is illustrated in figure 2.

The maxillae of almost all of the larger comparative skeletons of *Anolis* are also provided with numerous small rugosities. Such sculpturing is also found on the fossil elements. However, the fossil maxillae differ from those in *A. porcatus*, where the upper surface is produced upwards and outwards, forming a very sharp and evident canthus. This ridge is covered by several long, narrow, and heavily keeled scales. A canthus is developed in the fossil elements, but not nearly as strongly, and the rugosities suggest much smaller scales in this area. The remaining external portions of the fossils are covered with fine sculpturing, but not strong enough to provide data concerning scalation in this area.

In all of the fossil elements there is a very close agreement between them, and there is every reason to believe that only one species is represented by these remains. Futhermore, the fossils are almost identical to the same elements from Recent skeletons of *Anolis carolinensis*. On the basis of other studies on reptile and amphibian faunas of Middle and Late Pleistocene deposits of Florida there is little reason to expect a species of *Anolis* in these deposits different from the one now inhabiting eastern United States. Two of the fossil dentaries have a slightly higher number of teeth than are found in *carolinensis*. It is interesting that these two elements are larger than any other fossil or Recent specimen known from Florida. Possibly correlated with this is the fact that both of these elements were taken from a deposit that may represent Thermal Maximum time. Brattstrom (1953b) has inferred slightly warmer climatic conditions for a single Pleistocene locality in California on the basis of a somewhat larger form of rattlesnake of the viridis group *(Crotalus potterensis).* Cowles (1945) has applied Bergman's principle in interpreting past climates on the basis of size of reptiles in general. However, the problem of determining minor climatological shifts in the Pleistocene based on the size of a few vertebrae or dentaries is obviously quite complex, if not impossible. Temperature is certainly not the sole factor in determining size in local populations of reptiles. There are numerous examples of species of snakes in which more northern populations, living under cooler conditions, and in areas of shorter annual periods of activity attain a larger size than populations of the same species inhabiting more southerly regions.

Sceloporus undulatus

Brattstrom (1953a) has reported this species from Vero, Stratum 3, St. Lucie County, on the basis of two dentaries (FGS V-1530). No additional material has come to light since that time. It should be pointed out that Stratum 3 may represent admixture between Sangamon, Wisconsin, Post Wisconsin or Recent faunas. The genus is best included in a list of Pleistocene vertebrates of Florida on a tentative basis.

Ophisaurus ventralis

This species has been reported previously from both Pleistocene and Pliocene deposits in Florida (Auffenberg, 1955). It is now known from an additional locality (Winter Beach-Luther), perhaps representing Thermal Maximum time. The specimen is a thoracic vertebra (UF 5830). The vertebral ratios of this specimen fall within those of *O. ventralis* rather than *O. attenuatus* or *O. compressus.*

Eumeces cf. *fasciatus*

This genus has previously been reported from Vero, Stratum 3 (Brattstrom, 1953a; FGS V-1530). The stratigraphic problems associated with this local deposit have already been alluded to above. Two additional dentaries (UF 5086) are now available from Reddick I B, a definite Pleistocene deposit, probably Illinoian in age. One of these specimens in illustrated in figure 3.

The fossil elements have been compared with modern dentaries of *Eumeces laticeps, E. inexpectatus* and *E. fasciatus.* In addition, the number of dentary teeth have been counted in a few other species.

There are no apparent differences between the dentaries of the available modern species and the fossils. They are similar in size, shape and proportions. However, the number of teeth is greater in the single complete fossil dentary (27) than in the species now inhabiting peninsular Florida (*E. laticeps* and *E. inexpectatus; E. egregius* is separable from the fossils on the basis of much smaller size). In *laticeps* and *inexpectatus* the teeth vary in number from 21-25. In *E. fasciatus* they range from 25-26. I have counted the following number of dentary teeth in several other species of *Eumeces: skiltonensis* 19, *tetragramus* 19-21, *humilis* 18-19, *schneideri* 18, *septentrionalis* 17-20, *chinensis* 23-24, *obsoletus* 20-21 and *longirostris* 18-20.

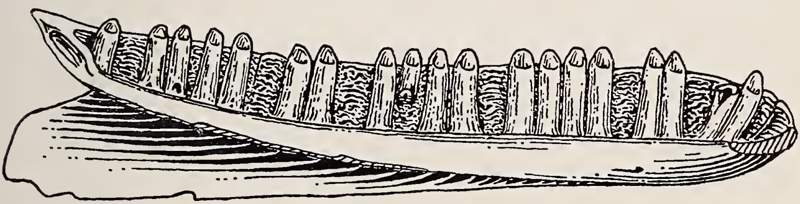

Fig. 3. Fossil left dentary referred to *Eumeces* cf. *fasciatus*, lingual view, UF 5086, Reddick I, Marion County, Florida. Pleistocene, Illinoian?

The number of dentary teeth in most species of this genus is thus lower than in the fossil. A much greater overall range in number of teeth is found in the iguanid, *Anolis carolinensis* than in any single species of *Eumeces*. However, it is not known whether or not the observed difference in variability is real, since the sample in *Eumeces* is much smaller than in *Anolis carolinensis*. On the basis of the skeletal material examined, the number of teeth is much more constant in *Eumeces* than in *Anolis*, and seems to provide a character of some merit in identifying fossil specimens of this genus. The question of the exact variability of teeth in lizards would seem to provide an interesting and worthwhile research problem. The character has been used many times in both paleontological and modern herpetological literature. Yet, no extensive studies have been made of this variability.

The shape of the cusps and shafts of the teeth of the fossil elements, the Meckelian groove and the shape and position of the external mandibular foramena are all in perfect agreement with *Eumeces.* Of the modern species, *E. fasciatus* comes closer in number of dentary teeth than any other species which I have been able to examine. On the basis of modern skulls of *E. laticeps* and *E. inexpectatus* there is little reason to believe that the number of dentary teeth in this genus is as variable as in *Anolis.* The fossil dentaries are thus referred to *E. fasciatus,* at least provisionally.

The presence of *fasciatus* in central Florida as a Pleistocene fossil is of considerable interest, since at the present time the form is apparently restricted to the extreme northern part of the State in the vicinity of the Appalachicola River (Neill and Allen, 1950). The deposit from which the fossils were taken is believed to represent Illinoian time, a period when more northern faunal elements would be expected to be present in the peninsula of Florida. The same deposit contains numerous remains of *Carphophis amoena,* a snake, which if present at all in Florida at the present time, is restricted to the northern portion of the peninsula (Auffenberg, 1956. Thesis).

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